Peter Lindstrom

Peter Lindstrom is like a traffic controller for computer data.

As a recipient of a Department of Energy Office of Science 2011 Early Career Research Program award, Lindstrom, 41, plans to use his $2.5 million grant over five years to alleviate the data-movement bottleneck in extreme-scale computing to accelerate numerical simulation and data analysis.

Lindstrom, a computer scientist in the Lab's Center for Applied Scientific Computing (CASC), earned his Ph.D. in computer science from Georgia Institute of Technology in 2000. He joined LLNL in 2000 and is a member of CASC's Data Analysis Group and the Advanced Simulation and Computing (ASC) Program's visualization team.

Lindstrom's research will focus on software solutions to reduce the amount of data transferred between memory banks, across distributed compute nodes and between main memory and secondary storage. This project will take a three-pronged approach based on maximizing data localality by optimally reordering data elements, improving computing locality using parallel stream processing and integrating high-speed data compression.

His new techniques will limit the total size of data moved, minimize data accesses and make effective use of multilevel caches to keep data as close to the processor as possible. The work will lead to new tools for greatly reducing data movement with commensurate increases in performance and reductions in power consumption on next-generation massively multi-core computer architectures.

"In a sense the work I proposed is a logical extension of the exploratory research I started several years back as principal investigator for the Laboratory Directed Research and Development LOCAL project," Lindstrom said. "I will be able to tackle problems of greater scope than would be possible on the shorter time scale and limited amount of funding normally available through LDRD and similar funding streams."

The Locality-Optimizing Caching Algorithms and Layouts (LOCAL) project developed techniques to reduce bandwidth requirements for large unstructured data, by making use of data compression and optimizing the layout of the data for better locality and cache reuse.

Lindstrom, whose funding was awarded through the Office of Advanced Scientific Computing Research (ASCR), said the new project will target data movement challenges for next-generation massively multicore and heterogeneous computers that are likely to emerge as the world approaches exascale computing, in which the Lab and DOE are heavily invested.

“Given how competitive the Early Career Research Program is, I feel very honored that ASCR chose to fund my proposal,” he said. “I am thrilled to now have the funding and time to continue this research. I am particularly pleased to have secured stable funding for the next several years, which will allow me to pursue a long-term, coherent research agenda. I am eager to get started and hope to contribute to the Lab's efforts in exascale computing.”

Lindstrom said the ECRP project is synergistic with another research effort that he leads on a separate Office of Science funded project.